

Isothermal Technology



Parallel Tube Liquid Bath: Model 915

Evaluation Report

- Working Volume 100mm x 400mm deep
- Liquid Capacity Approximately 7L
- Stability See Graphs
- Outstanding Vertical Profile
- Comparison Accuracy $< 0.001^{\circ}\text{C}$



The Isotech 915 Parallel Tube Liquid Calibration Bath is widely used throughout the world for the calibration of thermometers to very low uncertainties. The temperature range of the 915H is 40 to 300°C. When used with a chiller the range can be extended to -65°C. Liquids are circulated by a propeller which mixes and forces the liquid through a specially designed orifice in the rear of the two parallel tubes. The liquid flows up the central calibration tube into a collection tray where it returns to the rear tube for circulation.

This evaluation report describes the performance of this bath, the intent is to provide a guide to the performance that can be expected in the calibration laboratory. When comparing uncertainties and bath performance it is important to check that the specifications being compared are like for like, if in doubt please contact Isotech for advice. There is no agreed International standard for the expression of comparison bath performance and some other parties, without accredited labs of their own, have made claims which can lead to disappointment when a laboratory needs to measure the actual bath performance to establish calibration uncertainty.

Isotech operates a UKAS Accredited Calibration Laboratory – equipped with bath's of our own manufacture – check our schedule, ask for a copy or visit, <http://www.isotech.co.uk/lab.html> Our uncertainty for the calibration of platinum resistance thermometers using the 915H bath is 0.005 to 0.010°C at $k=2$, or 0.0025 to 0.005 at $k=1$; and *this includes the uncertainty of both the bath, the standard and the measuring instrument.*

Performance Detail: Comparison Calibration –30°C to 250°C

The 915 can be used for many purposes; its primary design is for the calibration of standard and industrial temperature sensors, by comparison of the unknown sensor to a calibrated standard.

Comparison Accuracy

In this test series thermometers are placed into the standard support block and then swapped between pockets, the difference between thermometers can then be recorded. In table 1 two Model 909/25 Ohm SPRTs are compared, table 2 is for a 100 Ohm PT100 thermometer compared against a Model 909/25 Ohm SPRT, this is the most usual application for the 915 Bath. 915 Eval 7/95Iss1

| Table 1 | 909 vs 909 | Table 2 | 909 vs Pt100 |
|--------------------|-------------------|--------------------|---------------------|
| Temperature | Difference | Temperature | Difference |
| -30°C Methanol | 0.1mK | -30°C Methanol | 0.005mK |
| 0°C Methanol | 0.2mK | | |
| 50°C Water | 0.33mK | | |
| 100°C Medium Oil | 0.13mK | | |
| 250°C VH Oil | 0.3mK | 250°C VH Oil | 0.7mK |

Performance Detail: Stability

On occasions, the bath's absolute stability is required and also the thermal profile needs to be evaluated, these for sensors whose length or mass is dissimilar to the reference standard.

Stability or *absolute stability*, we define as the variation in temperature, with time, of the liquid in the calibration volume.

The stability was measured directly in the liquid – *Not* in the support or equalizing block

The 915 Bath has a very wide operating range and it is not feasible to record the stability at every temperature, with every accessory and liquid combination.

The stability is reported for the following combinations,

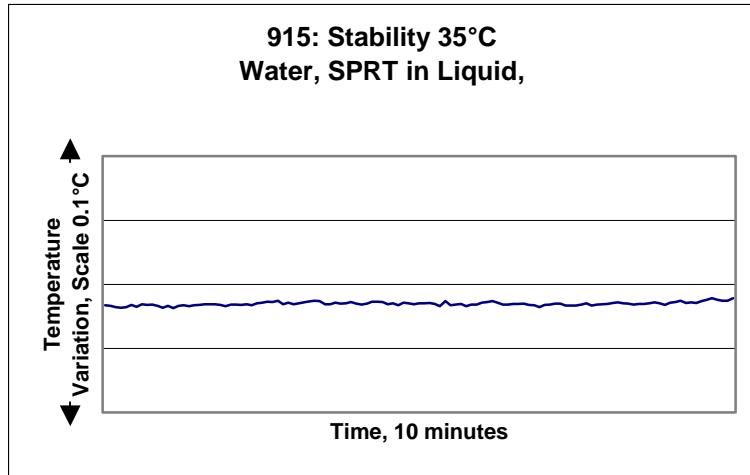
| Set Temperature | Liquid | Chiller Type |
|------------------------|-------------------------|---------------------|
| 35°C | Water | N/A |
| 50°C | Isotech VH Silicone Oil | N/A |
| 0°C | Methanol | Single Stage (915M) |
| -65°C | Methanol | Dual Stage (915L) |
| 125°C | Isotech VH Silicone Oil | N/A |

Stability at 35°C,
 measured in Liquid with a
 model 909/25 Ohm
 standard platinum
 resistance thermometer.
 (Water)

Stability Values

**+/- 0.004°C over a 10
 minute period.**

**+/-0.007°C over a 60
 minute period.**

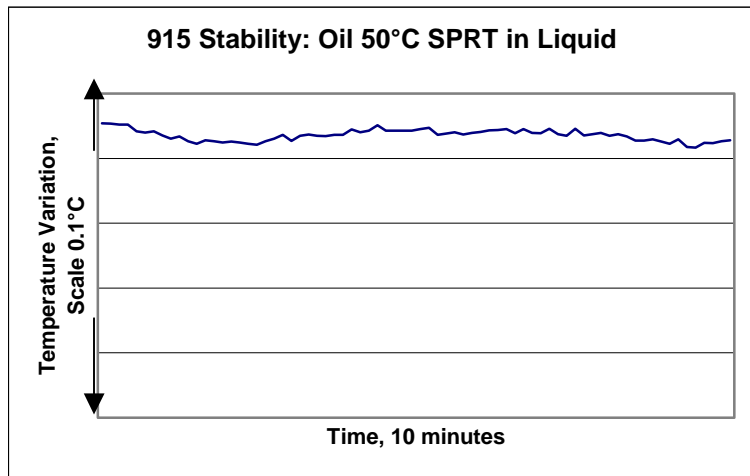


Stability at 50°C,
 measured in Liquid with a
 model 909/25 Ohm
 standard platinum
 resistance thermometer.
 (Oil)

Stability Values

**+/- 0.004°C over a 10
 minute period.**

**+/-0.006°C over a 60
 minute period.**

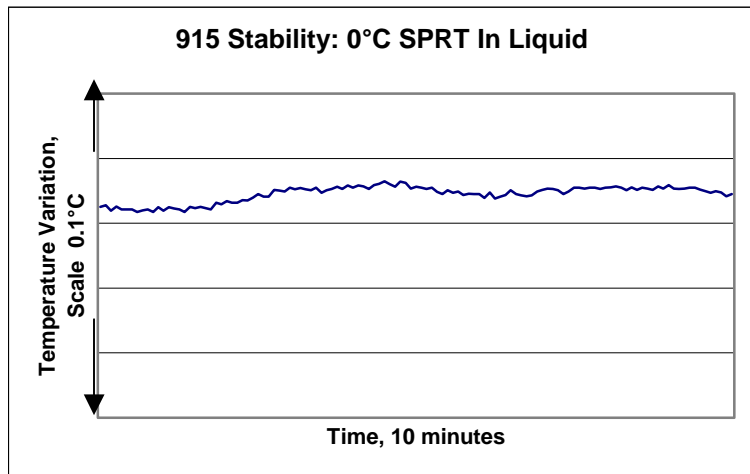


Stability at 0°C, measured
 in Liquid with a model
 909/25 Ohm standard
 platinum resistance
 thermometer. (Methanol)

Stability Values

**+/- 0.005°C over a 10
 minute period.**

**+/-0.010°C over a 60
 minute period.**

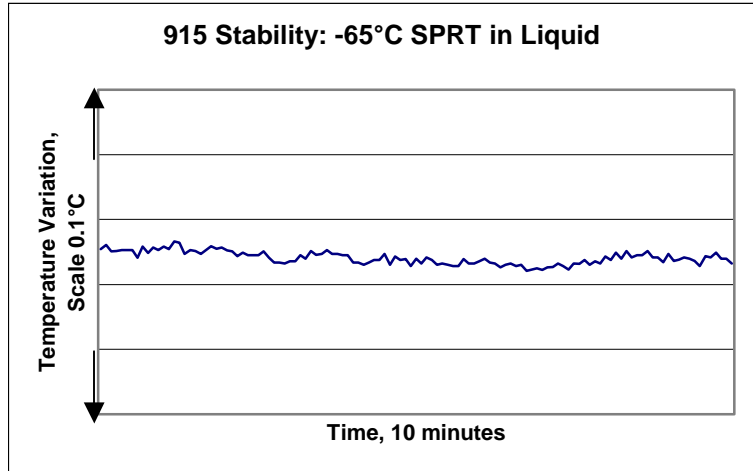


Stability at -65°C, measured in Liquid with a model 909/25 Ohm standard platinum resistance thermometer. (Methanol)

Stability Values

+/- 0.005°C over a 10 minute period.

+/-0.009°C over a 60 minute period.

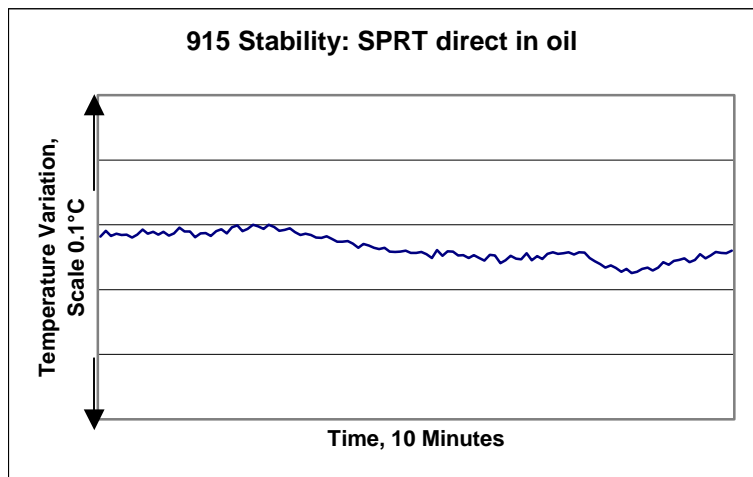


Stability at 125°C, measured in Liquid with a model 909/25 Ohm standard platinum resistance thermometer. (Silicone Oil)

Stability Values

+/- 0.007°C over a 10 minute period.

+/-0.010°C over a 60 minute period.



Conditions of Test

The graphs are from tests carried out under the following conditions,
 Model: Isotech 915, Digital Controller, Resolution 0.1°C

Measuring Equipment:

Isotech TTI 2 Thermometer, resolution 0.01 (Statistics Mode)
 Data recorded with CalNotePad Software, sampling rate 5 seconds
 Thermometers Used: Isotech Model 909/25 Ohm Standard Platinum Resistance Thermometers, *SPRT*.

Environmental:

Ambient Temperature 23°C variation better than +/-2°C
 Supply Voltage 230VAC (Stable)

Results shown are typical for the above conditions and do not constitute a formal specification

Performance Detail: Vertical Temperature Gradient

Reported for two conditions,

A, Water 50°C +/- 0.2mK

Two Model 909/25 Ohm SPRTs were immersed directly into the liquid to a depth of 360mm, one probe was left whilst the second was withdrawn in steps, the measurement resolution was 0.00001°C, 0.01mK. The probe calibration errors were cancelled and the variation over a distance of 150mm was found to be +/-0.2mK. 915 Eval 7/95Iss1

B, Isotech VH Oil 200°C +/- 3mK

Two Model 909/25 Ohm SPRTs were immersed into 8mm pockets of a support / equalizing block to a depth of 300mm one probe was left whilst the second was withdrawn in steps, the measurement resolution was 0.00001°C, 0.01mK. The probe calibration errors were cancelled and the variation over a distance of 120mm was found to be +/-3mK.

This includes the measurement error, the immersion or stem conduction error will increase as the long stem SPRT is withdrawn. 915 Thermal Survey 0/00

Performance Detail: Horizontal Temperature Gradient

A, Water 50°C +/- 0.5mK

Two Model 909/25 Ohm SPRTs were immersed directly into the liquid to a depth of 360mm, the probes were first placed together in the center of the calibration tube. Secondly they were moved to the extreme outer area of the tube approximately 3mm from the tube wall – the difference was found to be 0.5mK 915 Eval 7/95Iss1

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| Issue 01 | 12 April 2000 | Approved: JPT |
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